

WHAT IS CLAIMED IS:

1. A filter for removing microorganisms from a fluid, comprising:
  - a) a housing having an inlet and an outlet; and
  - b) a filter material disposed within said housing formed at least in part from a plurality of filter particles having an activated coating, wherein said coating comprises a lignosulfonate.
2. The filter of claim 1, wherein said lignosulfonate is selected from the group consisting of ammonium lignosulfonate, zinc lignosulfonate, calcium lignosulfonate, ferric lignosulfonate, magnesium lignosulfonate, chromium lignosulfonate, manganese lignosulfonate, sodium lignosulfonate, copper lignosulfonate, and mixtures thereof.
3. The filter of claim 1, wherein said plurality of filter particles are selected from the group consisting of glass fibers, screens, ceramic fibers, wovens, non-wovens, and mixtures thereof.
4. The filter of claim 1, wherein the carbon add-on in said activated coating is between about 0.1% and about 85%.
5. The filter of claim 1, wherein the carbon add-on in said activated coating is between about 0.5% and about 45%.
6. The filter of claim 1, wherein the BET surface area of one or more of said filter particles is between about 500 m<sup>2</sup>/g and about 3000 m<sup>2</sup>/g.
7. The filter of claim 1, wherein the sum of the mesopore and macropore volumes of one or more of said filter particles is between about 0.2 mL/g and about 2.2 mL/g.

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Sub-B2

8. The filter of claim 1, wherein the ratio of the sum of the mesopore and macropore volumes to the micropore volume of one or more of said filter particles is between about 0.3 and about 3.
9. A filter for removing microorganisms from a fluid, comprising:
- a) a housing having an inlet and an outlet; and
  - b) a filter material disposed within said housing formed at least in part from a plurality of filter particles having an activated coating comprising a lignosulfonate, wherein the BET surface area of one or more of said filter particles is between about 500 m<sup>2</sup>/g and about 3000 m<sup>2</sup>/g.
10. The filter of claim 9, wherein said lignosulfonate is selected from the group consisting of ammonium lignosulfonate, zinc lignosulfonate, calcium lignosulfonate, ferric lignosulfonate, magnesium lignosulfonate, chromium lignosulfonate, manganese lignosulfonate, sodium lignosulfonate, copper lignosulfonate, and mixtures thereof.
11. The filter of claim 9, wherein said plurality of filter particles are selected from the group consisting of glass fibers, screens, ceramic fibers, wovens, non-wovens, and mixtures thereof.
12. The filter of claim 9, wherein the carbon add-on in said activated coating is less than about 85%.
13. The filter of claim 9, wherein the carbon add-on in said activated coating is between about 0.1% and about 85%.
14. The filter of claim 9, wherein the carbon add-on in said activated coating is between about 0.5% and about 45%.

- Figure 1. The  $^{13}\text{C}$  NMR spectra of the polyimides 1a and 1b. The chemical structures of the polyimides 1a and 1b are shown in the inset.

*See B5*

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~~claim 17, wherein the filter part of said filter part~~

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31. The filter of claim 17, wherein the ratio of the sum of the mesopore and macropore volumes to the micropore volume of one or more of said filter particles is between about 0.3 and about 3.
32. A filter for removing microorganisms from a fluid, comprising:
- a) a housing having an inlet and an outlet; and
  - b) a filter material disposed within said housing formed at least in part from a plurality of filter particles having an activated coating comprising a lignosulfonate, wherein the carbon add-on in said activated coating is less than about 85%, and wherein the BRI of said filter particles is greater than 99.9%, and the VRI of said filter particles is greater than about 95%.
33. The filter of claim 32, wherein said lignosulfonate is selected from the group consisting of ammonium lignosulfonate, zinc lignosulfonate, calcium lignosulfonate, ferric lignosulfonate, magnesium lignosulfonate, chromium lignosulfonate, manganese lignosulfonate, sodium lignosulfonate, copper lignosulfonate, and mixtures thereof.
34. The filter of claim 32, wherein said plurality of filter particles are selected from the group consisting of glass fibers, screens, ceramic fibers, wovens, non-wovens, and mixtures thereof comprise glass fibers.
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35. The filter of claim 32, wherein the BET surface area of one or more of said filter particles is between about 500 m<sup>2</sup>/g and about 3000 m<sup>2</sup>/g.
36. The filter of claim 32, wherein the sum of the mesopore and macropore volumes of one or more of said filter particles is between about 0.2 mL/g and about 2.2 mL/g.

37. The filter of claim 32, wherein the ratio of the sum of the mesopore and macropore volumes to the micropore volume of one or more of said filter particles is between about 0.3 and about 3.
38. A filter material for removing microorganisms from a fluid, comprising a filter particle having an activated coating, wherein said coating comprises a lignosulfonate.
39. The filter material of claim 38, wherein said lignosulfonate is selected from the group consisting of ammonium lignosulfonate, zinc lignosulfonate, calcium lignosulfonate, ferric lignosulfonate, magnesium lignosulfonate, chromium lignosulfonate, manganese lignosulfonate, sodium lignosulfonate, copper lignosulfonate, and mixtures thereof.
40. The filter material of claim 38, wherein said filter particle is selected from the group consisting of glass fibers, screens, ceramic fibers, wovens, non-wovens, and mixtures thereof.
41. The filter material of claim 38, wherein the BET surface area of said filter particle is between about 500 m<sup>2</sup>/g and about 3000 m<sup>2</sup>/g.
42. The filter material of claim 38, wherein the sum of the mesopore and macropore volumes of said filter particle is between about 0.2 mL/g and about 2.2 mL/g.
43. The filter material of claim 38, wherein the ratio of the sum of the mesopore and macropore volumes to the micropore volume of said filter particle is between about 0.3 and about 3.
44. The filter material of claim 38, wherein the carbon add-on in said activated coating is between about 0.1% and about 85%.

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45. The filter material of claim 38, wherein the carbon add-on in said activated coating is between about 0.5% and about 45%.
46. A filter material for removing microorganisms from a fluid, comprising a filter particle having an activated coating comprising a lignosulfonate, wherein the BET surface area of said filter particle is between about 500 m<sup>2</sup>/g and about 3000 m<sup>2</sup>/g.
47. The filter material of claim 46, wherein said lignosulfonate is selected from the group consisting of ammonium lignosulfonate, zinc lignosulfonate, calcium lignosulfonate, ferric lignosulfonate, magnesium lignosulfonate, chromium lignosulfonate, manganese lignosulfonate, sodium lignosulfonate, copper lignosulfonate, and mixtures thereof.
48. The filter material of claim 46, wherein said filter particle is selected from the group consisting of glass fibers, screens, ceramic fibers, wovens, non-wovens, and mixtures thereof comprise glass fibers.
49. The filter material of claim 46, wherein the sum of the mesopore and macropore volumes of said filter particle is between about 0.2 mL/g and about 2.2 mL/g.
50. The filter material of claim 46, wherein the ratio of the sum of the mesopore and macropore volumes to the micropore volume is between about 0.3 and about 3.
51. The filter material of claim 46, wherein the carbon add-on in said activated coating is between about 0.1% and about 85%.
52. The filter material of claim 46, wherein the carbon add-on in said activated coating is between about 0.5% and about 45%.

53. A process for filtering microorganisms from a fluid, comprising the steps of:
- a) providing a filter material comprising a plurality of filter particles having an activated coating, wherein said coating comprises a lignosulfonate; and
  - b) passing a fluid through said filter material.
54. The process of claim 53, wherein said fluid is water.
55. A process for filtering microorganisms from a fluid, comprising the steps of:
- a) providing a housing having an inlet, an outlet, and a filter material disposed within said housing formed at least in part from a plurality of filter particles having an activated coating, wherein said coating comprises a lignosulfonate and wherein the BET surface area of said filter particles is between about 500 m<sup>2</sup>/g and about 3000 m<sup>2</sup>/g; and
  - b) passing a fluid through said filter material.
56. The process of claim 55, wherein said fluid is water.
57. A process for filtering microorganisms from a fluid, comprising the steps of:
- a) providing a filter material formed at least in part from a plurality of filter particles having an activated coating, wherein said coating comprises a lignosulfonate, wherein the carbon add-on in said activated coating is less than about 85%, wherein the BRI of said filter particles is greater than 99.9%; and
  - b) passing a fluid through said filter material.
58. The process of claim 57, wherein said fluid is water.
59. A process for filtering microorganisms from a fluid, comprising the steps of:
- a) providing a filter material formed at least in part from a plurality of filter particles having an activated coating, wherein said coating comprises a lignosulfonate, wherein the carbon add-on in said activated coating is less



than about 85%, and wherein the BRI of said filter particles is greater than 99.99%; and

b) passing a fluid through said filter material.

60. The process of claim 59, wherein said fluid is water.

61. A process for filtering microorganisms from a fluid, comprising the steps of:

- a) providing a filter material formed at least in part from a plurality of filter particles having an activated coating, wherein said coating comprises a lignosulfonate, wherein the carbon content in said activated coating is less than about 85%, wherein the BRI of said filter particles is greater than 99.9%, and the VRI of said filter particles is greater than about 99%; and
- b) passing a fluid through said filter material.

62. The process of claim 61, wherein said fluid is water.

63. A process for filtering microorganisms from a fluid, comprising the steps of:

- c) providing a filter material formed at least in part from a plurality of filter particles having an activated coating, wherein said coating comprises a lignosulfonate, wherein the carbon content in said activated coating is less than about 85%, wherein the BRI of said filter particles is greater than 99.999%, and the VRI of said filter particles is greater than about 99.9%; and
- d) passing a fluid through said filter material.

64. The process of claim 63, wherein said fluid is water.